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The effect of competition on the relationship between the introduction of the DRG system and quality of care in Korea

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Background: The diagnosis-related group-based prospective payment programme was introduced in Korea in 1997 as a pilot programme to control health spending. In July 2013, the programme was implemented throughout the nation. The aim of our study is to evaluate the relationship between quality of care and market competition following the introduction of the new payment system in Korea. **Methods**: We conduct an observational analysis using National Health Insurance claim data from 2011 to 2014. We analyse data on re-admission within 30 days, length of stay, and number of outpatient visits for 1742 hospitals and 821 912 cases. We use a generalized estimating equation model to evaluate readmission within 30 days and number of outpatient visits and a multi-level regression model to assess length of stay. **Results**: Total readmission within 30 days is 10 727 (1.3%). High competition areas present a lower risk of readmission [odds ratio (OR): 0.95, *P*: 0.0277], a longer length of stay (1%, $P<0.0001$), and an increased number of outpatient visits (Relative Risk: 1.11, *P*: 0.0011) as compared with moderate competition areas. Risk of readmission is higher in low competition areas as compared with moderate competition areas (OR: 1.21, $P<0.0001$). **Conclusion:** The effects of the introduction of the new payment system differed by degree of market competition. Thus, evaluation about the effect of new payment system on hospital performance should be measured in combination with the degree of hospital market structure.

Introduction

In recent years, health spending growth has exceeded economic growth in many countries. This is the result of an overall increased interest in health.[1] To control health spending, a diagnosis-related group (DRG) based payment programme was suggested as a health care system in the USA. Following the introduction of the DRG system in the USA, many countries have adopted it and modified it based on their individual needs.[2,3]

In Korea, average annual growth in health spending and health expenditures during 2000–12 increased faster than that of the Organisation for Economic Co-operation and Development (OECD) Asia region (Asia region: 4.6%, Korea: 7.5%).[1] The DRG system was introduced in 1997 as a way to control health spending and to improve health efficiency in Korea. The Korean-DRG system was based on the US Yale Refined DRG system.[4] The criteria for DRG were selected by evaluating the variation in medical expenditures that were similar clinically as well as similar in consumption of resources. Following the pilot programme, which lasted for several years, the DRG system was implemented for seven disease groups in 2002 through voluntary participation. Recently, the DRG system was implemented throughout the nation, resulting in changes for Korea's health care system. The implementation of the DRG system for hospitals and clinics became mandatory on 1 July 2012 and for general and tertiary hospitals on 1 July 2013. These changes in the payment mechanisms for hospitals care affected competition among hospitals[5,6] primarily through hospital performance and quality of care.[7–10] In response to the new payment system, hospitals adopted various cost-saving strategies and changed their medical health behaviour. In addition, changes in hospital performance differed according to degree of market competition. The differences in market competition affected hospital behaviour and led to differences in quality of care.

Previous studies suggest that introduction of the health care system influenced competition in the market.[11] Further studies on quality of care and market competition were conducted by many other researchers[12,13] and concerns regarding the introduction of the DRG system and quality of care were noted.[14] In addition, other studies have found benefits to the DRG system, such as a reduction in healthcare costs and length of stay (LOS).[15,16]

In Korea, many studies have been conducted on the association between the quality of care and the DRG system.[17–19] However, few studies have been conducted after mandatory adoption of DRG system in Korea. In addition, hospitals in Korea have undergone dramatic changes within a few decades and studies on the effects of market competition are needed.

Thus, the purpose of this study is to examine the association between the effects of market competition and quality of care following the introduction of the DRG system in Korea. We use data on readmission within 30 days after discharge, number of outpatient visits and LOS to measure quality of care and changes in hospital behaviour.

Methods

Database and data collection

We used National Health Insurance (NHI) claim data collected during July 2011 to July 2014 for patients admitted to hospitals due to haemorrhoids (Korean DRG codes: G1020, G1040, G1050 and G1060). Each DRG code is subdivided by severity of complication and comorbidity. We included clinic in our study because more than 50% of patients were admitted to clinics. In Korea, clinics have operating rooms and facilities for inpatients. Additionally, we analysed data on readmission within 30 days after discharge, LOS and number of outpatient visits within 30 days of admission from 1742 hospitals. Our analysis included 821 912 hospitalizations.

Variables

The outcome variable used in this study is readmission within 30 days after discharge for haemorrhoids. We identified the patient's first hospitalization and discharge in the calendar year as the first index hospitalization and discharge. Next, we examined whether readmission occurred within 30 days after the first index day in the same hospital or another hospital. Furthermore, we matched the patient's primary diagnosis of the first hospitalization and that of the readmission and defined it as a readmission. LOS was measured using date of admission and date of discharge. We used a log transformation for LOS to reflect the original scale of the skewed data and to measure the relationship by estimating changes in the dependent variable in response to per cent changes in the explanatory variable (for further details, see Supplementary data 1).[20–23] Number of outpatient visits was defined as visiting an outpatient clinic within 30 days before or after hospitalization, based on the day of admission or discharge, respectively.

We extracted patient-level data and matched hospital-level data for the hospital to which the patient had been admitted. Hospital-level data included hospital type (tertiary hospital, general hospital, hospital or clinic), ownership status (private or public), teaching status (teaching or non-teaching), size (number of beds), case mix index and hospital location (urban or rural). Data on the introduction of the DRG system was classified by newly introduced organizations or continuously adopted organizations. Clinics and hospitals were required to implement the DRG system from 1 July 2012. Both general hospitals and tertiary hospitals were required to implement the DRG system from 1 July 2013. Newly introduced organizations were defined as hospitals that participated in the DRG system during the mandatory period, whereas hospitals that had previously voluntarily participated in the DRG system were classified as continuously adopted organizations. Human resources (doctors, nurses and pharmacists) were included to reflect differences in hospital scale. Patient-level data included patient ID, sex, age, patient clinical complexity level and year.

The Hirschmann–Herfindal Index (HHI) was used to reflect the degree of market competition. HHI was calculated using patient claim data from all hospitals using the following equation.

$$\text{Hirschmann} - \text{Herfindal Index (HHI)} = \sum_{i=0}^{n} S_i^2$$

The HHI is the sum of squared market share of hospital under the defined market. Market share S_i is calculated using the total discharged patients for haemorrhoid, i indicates each hospital and n is the total number of hospitals in a specific market area, meaning that high HHI indicates low market competition or hospital had a dominant effect in the market area. To measure the different effects of market competition, we categorized market competition as high, moderate or low using quartiles of HHI.

Statistical analysis

The distribution of each categorical variable was examined by an analysis of frequencies and percentages, and χ^2 tests were performed to examine associations with readmission within 30 days. Analysis of variance was also performed to compare the average values and standard deviations for continuous variables. Generalized estimating equation regression models were used to examine associations with readmission within 30 days after discharge and number of outpatient visits. Multi-level regression models were used to investigate the association between LOS and each variable (Null model ICC: 0.685, for further details, see Supplementary data 1).[24,25] In addition, subgroup analyses were performed according to the introduction of the DRG system and type of hospital. All statistical analyses were performed using SAS statistical software version 9.3. P-values < 0.05 were considered indicative of statistically significant differences.

Results

The data used in this study consisted of 821 912 hospitalizations and 1742 hospitals. There were 10 727 (1.3%) cases of readmission within 30 days after discharge. The average LOS was the shortest in moderate competition areas, whereas low competition areas had the longest LOS as compared with other areas. Number of outpatient visits was highest in low competition areas and lowest in moderate competition areas (table 1).

We used generalized estimating equation models to evaluate readmission within 30 days after discharge. Interestingly, the risk of readmission was higher in low competition areas [odds ratio (OR): 1.21, $P < 0.0001$] as compared with moderate competition areas. High competition areas had a lower risk of readmission (OR: 0.95, P-value: 0.0277) as compared with moderate competition areas. LOS was slightly (1%) higher in high competition areas as compared with moderate competition areas. Number of outpatient visits was higher in both high and low competition areas as compared with moderate competition areas (high competition areas—relative risk (RR): 1.11, P-value: 0.0011; low competition areas—RR: 1.06, P-value: 0.2485) (table 2).

According to the subgroup analysis of the introduction of the DRG system, newly introduced organizations located in high and low competition areas had a high risk of readmission within 30 days that was not statistically significant. LOS was significantly decreased in high competition areas (2.7%, P: 0.0004). In the case of number of outpatient visits, low competition areas had a lower number of outpatient visits and high competition areas had a higher outpatient visits (high competition area—RR: 1.15; low competition area—RR: 0.98). Continuously adopted organizations that voluntarily implemented the DRG system showed trends similar to the main results. High competition areas presented a lower risk of readmission, a higher LOS, and a higher number of outpatient visits, all of which were statistically significant (readmission—OR: 0.90; LOS—1%; number of outpatient visits—RR: 1.09). In contrast with high competition areas, low competition areas had a higher risk of readmission within 30 days and a higher number of outpatient visits (readmission—OR: 1.24; number of outpatient visits—RR: 1.06). The subgroup analysis showed that clinics and hospitals displayed similar trends for each outcome variable. Readmission was higher in low competition areas, whereas lower in high competition areas. LOS increased by 0.64% to 1.50% in the high competition area. Number of outpatient visits was higher in both the high and low competition areas. Except for readmission, general and tertiary hospitals showed similar trends in LOS and outpatient visits. However, the impact on number of outpatient visits for general and tertiary hospitals were higher in the low and high competition areas; these findings were statistically significantly (table 3).

Table 1 Characteristics of outcome variable, patients, hospital and regional level

	Total		High competition		Moderate competition		Low competition		*P*-value
Main interest									
HHI	449.86	±352.46	217.20	±13.01	377.43	±103.95	1156.57	±449.19	<.0001
Outcome variable									
Readmission	10 727	(1.3)	3291	(1.2)	6347	(1.3)	1089	(1.4)	0.0001
LOS[a]	3.00	±1.80	3.03	±1.78	2.96	±1.82	3.19	±1.73	<.0001
Number of outpatient visits	3.95	±2.72	4.26	±2.76	3.70	±2.64	4.38	±2.90	<.0001
Hospital characteristics (*n* = 1742)									
Hospital type									
Clinic	1003	(57.6)	280	(64.7)	583	(55.1)	140	(55.8)	0.0261
Hospital	410	(23.5)	90	(20.8)	261	(24.7)	59	(23.5)	
General hospital	284	(16.3)	57	(13.2)	182	(17.2)	45	(17.9)	
Tertiary hospital	45	(2.6)	6	(1.4)	32	(3.0)	7	(2.8)	
CMI	0.93	± 0.37	0.90	± 0.37	0.95	± 0.37	0.91	± 0.34	0.0448
Number of 100 beds	148.12	± 252.20	113.31	± 189.99	160.63	± 276.84	155.47	± 231.79	0.0039
Number of doctor per 100 beds	11.63	± 12.58	11.51	± 14.01	12.27	± 12.60	9.15	± 9.20	0.0021
Number of nurse per 100 beds	14.56	± 19.42	11.57	± 17.72	16.60	± 20.66	11.09	± 15.31	<.0001
Number of pharmacist	1.77	± 7.74	0.93	± 3.21	2.20	± 9.49	1.36	± 3.97	0.0104
Ownership status									
Private	1704	(97.8)	423	(97.7)	1040	(98.3)	241	(96.0)	0.1137
Public	38	(2.2)	10	(2.3)	18	(1.7)	10	(4.0)	
Introduction of DRG									
Newly adopted organization	868	(49.8)	242	(55.9)	515	(48.7)	111	(44.2)	0.0064
Continuously applied organization	874	(50.2)	191	(44.1)	543	(51.3)	140	(55.8)	
Teaching status									
Teaching	146	(8.4)	24	(5.5)	101	(9.6)	21	(8.4)	0.0316
Non-teaching	1596	(91.6)	409	(94.5)	957	(90.5)	230	(91.6)	
Hospital location									
Urban	1497	(85.9)	368	(85.0)	936	(88.5)	193	(76.9)	<.0001
Rural	245	(14.1)	65	(15.0)	122	(11.5)	58	(23.1)	
Patients characteristics									
Sex									
Male	473 699	(57.6)	154 145	(57.5)	273 415	(57.7)	46 139	(57.5)	0.3466
Female	348 213	(42.4)	113 727	(42.5)	200 427	(42.3)	34 059	(42.5)	
Age	42.27	± 14.33	42.05	± 14.38	42.34	± 14.26	42.62	± 14.59	<.0001
PCCL									
0	810 317	(98.6)	264 959	(98.9)	466 236	(98.4)	79 122	(98.7)	<.0001
1	10 453	(1.3)	2603	(1.0)	6930	(1.5)	920	(1.2)	
2	1142	(0.1)	310	(0.1)	676	(0.1)	156	(0.2)	
Year									
Period 1 (July 2011 to June 2012)	281 783	(34.3)	52 719	(19.7)	194 936	(41.1)	34 128	(42.6)	<.0001
Period 2 (July 2012 to June 2013)	274 716	(33.4)	108 858	(40.6)	142 500	(30.1)	23 358	(29.1)	
Period 3 (July 2013 to July 2014)	265 413	(32.3)	106 295	(39.7)	136 406	(28.8)	22 712	(28.3)	
Total	821 912	(100.0)	267 872	(32.6)	473 842	(57.7)	80 198	(9.8)	<.0001

(unit: n/mean, %/SD)
CMI, case mix index; PCCL, patient clinical complexity level.
a: Length of stay

Discussion

The introduction of a new payment system can affect a hospital's medical behaviour and may cause unexpected results according to the degree of market competition.[14] For example, hospitals located in high competition areas will make an effort to attract patients and hospitals located in low competition areas will focus on patient durability (i.e. continuous care).[26] The DRG system provides medical services for certain diseases according to a fixed amount, regardless of the type of hospital. Under the DRG system, patients can select a hospital without considering the burden of cost and will have the opportunity to choose their preferred hospital. In contrast, the hospital may change its existing medical services or medical behaviours.

Many previous studies have reported on the association between quality of care and market competition. Some studies have suggested that competition has a negative or unclear association with quality of care,[27,28] whereas others have suggested that competition induces better quality of care or is, at least, not associated with adverse effects.[12,29,30] Although some studies show that competitive area has better quality of care,[9] other studies suggested that it might be associated with supplier induced demand in Korea.[31,32] However, these studies did not measure other effects, such as spillover effects, under the DRG system. Furthermore, there have not been any studies conducted on the association between competition and quality of care in Korea after introduction of the DRG system. To investigate the changes in the Korean healthcare system following the introduction of the DRG system, we examined the association between market competition and quality of care.

In our study, hospitals located in high competition areas had a lower risk of readmission as compared with those in moderate competition areas. Because readmission within 30 days is suggested as an indicator of quality of care, hospitals in high competition areas made an effort to reduce readmission.[33,34] To maintain quality of care, hospitals provided further clinical care in the hospitalization or outpatient clinic. It might induce to increasing of LOS and number of outpatient visits. Increasing number of outpatient would be considered as a spillover effect. To control readmission, hospitals in high competition area would be provided additional clinical care in outpatient clinic, it lead to unintended results of

Table 2 The association of HHI on hospital readmission, LOS and number of outpatient visits

	Readmission		LOS[a]		Number of outpatient visits	
Main interest						
High competition	0.95	0.0277	0.0100	<0.0001	1.11	0.0011
Moderate competition	1.00		Ref	—	1.00	—
Low competition	1.21	<0.0001	0.0002	0.9451	1.06	0.2485
Hospital characteristics						
Hospital type						
Clinic	0.35	<0.0001	−0.3025	<0.0001	0.90	0.5215
Hospital	0.71	0.0019	−0.0343	0.3422	0.69	0.0128
General hospital	0.60	<0.0001	−0.1075	<0.0001	0.72	0.0039
Tertiary hospital	1.00		Ref	—	1.00	—
CMI	1.54	<0.0001	0.2607	<0.0001	0.90	0.3617
Number of 100 beds[b]	1.01	0.6525	0.0003	0.0015	0.91	0.0036
Number of doctor per 100 beds[b]	0.95	<0.0001	−0.0082	<0.0001	0.93	0.0018
Number of nurse per 100 beds[b]	1.04	<0.0001	0.0005	0.4045	0.99	0.3945
Number of pharmacist	1.00	0.7499	−0.0020	0.2786	1.02	0.0012
Ownership status						
Private	1.70	0.0173	−0.0635	0.2243	1.48	0.0004
Public	1.00		Ref	—	1.00	—
Introduction of DRG						
Newly adopted organization	1.06	0.2242	−0.0829	<0.0001	0.89	0.0325
Continuously applied organization	1.00		Ref	—	1.00	—
Teaching status						
Teaching	1.00		Ref	—	1.00	—
Non-teaching	1.08	0.2626	−0.0757	0.061	0.80	0.0033
Hospital location						
Urban	1.01	0.8960	−0.0527	0.0207	0.92	0.6375
Rural	1.00	—	Ref	—	1.00	—
Patients characteristics						
Sex						
Male	1.16	<0.0001	−0.0338	<0.0001	0.97	<0.0001
Female	1.00	—	Ref	—	1.00	—
Age	1.01	<0.0001	0.0018	<0.0001	1.00	<0.0001
LOS	1.10	<0.0001			1.04	<0.0001
PCCL						
0	1.00	—	Ref	—	1.00	—
1	1.30	0.0001	0.2169	<0.0001	0.85	0.0045
2	1.60	0.0008	0.5326	<0.0001	0.56	<0.0001
Year						
Period 1 (July 2011 to June 2012)	1.00	—	Ref	—	1.00	—
Period 2 (July 2012 to June 2013)	0.98	0.5326	−0.0360	<0.0001	1.03	0.0159
Period 3 (July 2013 to July 2014)	0.90	0.0001	−0.0614	<0.0001	1.04	0.0036
Goodness of fit (QIC or AIC)	109 797.6		215 278.3		−1 571 743.68	

(unit: OR, estimate, RR, *P*-value)
CMI, case mix index; PCCL, patient clinical complexity level.
a: Estimates are the results of log transformation and interpretable as percentage changes.
b: Per 10% increased in 30 days readmission and number of outpatient visits.

increasing outpatient visits. This scenario would be considered a spillover effect of the DRG system. In contrast, hospitals in low competition areas will not make significant efforts to improve quality of care because patients have few options for hospitals as compared with other competition areas.

Regarding the result of subgroup analysis by introduction of the DRG system, readmission was differed from the competitive status. Hospitals in high competition area that have recently adopted the DRG system will make an effort to reduce LOS for hospitalized patients. Under the DRG system, reimbursement differed by average LOS even though the amount was fixed. Hospital would be preferable to maintain the threshold of average LOS due to it was more beneficial. This may be connected with short LOS. In addition, postoperative care would be conducted in an outpatient clinic rather than requiring re-hospitalization; it might induce to increase in number of outpatient visits. This phenomenon might be observed during the introductory stages of the implementation of the DRG system; however, the results may be different after the settlement of the system. We found different results for readmission for the group of continuously adopted organizations. Hospitals in high competition areas will attempt to control quality of care, which might lead to a reduction in the rate of readmission within 30 days. Furthermore, to maintain quality of care, LOS increased slightly for postoperative care during hospitalization. On the contrary, outpatient care for postoperative care increased in order to reduce readmission. These results suggest that there are impacts of the implementation of the DRG system.

In low competition areas, there were no differences in trend for risk of readmission within 30 days based on the timing of the introduction of the DRG system. Because there were no changes in the quality of care in hospitals located in low competition areas, there may be an increased risk of readmission within 30 days regardless of timing of the introduction of the DRG system. In addition, number of outpatient visits was lower for newly adopted organization located in low competition areas. But, after the stabilization of the DRG system, these hospitals increased the number of outpatient visits and readmission. This is because that hospital can learn from their experiences with the DRG system and discover the options that will provide the highest profits.

The new payment system is expected to bring changes to the health system. However, the impact of the payment system should be considered together with the specific environment of the health

Table 3 Subgroup analysis of outcome variable according to DRG

	Readmission		LOS[a]		Number of outpatient visits	
Introduction of DRG system						
Newly adopted organization						
High competition	1.01	0.8311	−0.0278	0.0004	1.15	<0.0001
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	1.05	0.5222	0.0086	0.6474	0.98	0.0136
Continuously adopted organization						
High competition	0.90	0.0001	0.0100	<0.0001	1.09	<0.0001
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	1.24	<0.0001	0.0032	0.3431	1.06	<0.0001
Type of hospital						
Clinic						
High competition	0.98	0.6154	0.0064	0.0016	1.09	<0.0001
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	1.07	0.1457	−0.0028	0.3928	1.03	<0.0001
Hospital						
High competition	0.99	0.7468	0.0150	<0.0001	1.05	<0.0001
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	1.70	<0.0001	0.0177	0.1077	1.44	<0.0001
General hospital						
High competition	0.97	0.6825	−0.0072	0.4300	1.13	<0.0001
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	0.93	0.4893	0.0085	0.7388	1.02	0.0746
Tertiary hospital						
High competition	1.02	0.9067	−0.0381	0.2711	1.07	0.0050
Moderate competition	1.00	—	Ref	—	1.00	—
Low competition	1.20	0.4314	0.0806	0.1772	1.13	0.0002

(unit: OR, *P*-value)
Adjusted for type of hospital, CMI, number of beds, number of doctor per 100 beds, number of nurse per 100 beds, number of pharmacist, introduction of DRG, teaching status, city, sex, age, LOS and PCCL
a: Estimates are the results of log transformation and interpretable as percentage changes.

system of each country. In Korea, the DRG system was implemented as an alternative to the fee-for-service strategy, which was different from the European countries that had adopted global budget systems. Thus, the effects of DRG system may be different for Korea. The DRG payment system in Korea created more profitability for hospitals because the reimbursement level under the DRG system was greater on average than that under the fee-for-service system.[4] This reduced the number of disputes regarding the mandatory adoption of the DRG system.

However, many health providers still believe that the reimbursement level under the DRG system is too low, and this belief became predominant following the mandatory adoption of the DRG system.[4] Consequently, health care providers may attempt to compensate for any decrease in profit due to the DRG system by discharging patients earlier than expected (or needed) to potentially induce an increase in the use of other facilities or in outpatient visits. Spillover effect may appear through the increasing of outpatient visits.

In addition, the impact of introduction of DRG system was different by competitive status. Therefore, the expansion or development of a new reimbursement system must be implemented more carefully considering such differences. First, a suitable index for quality of care under the DRG system should be developed. Indicators for quality of care should be created for predictable readmission as well as for measuring actual changes in medical services. Second, the impact of the DRG system should be assessed over the long term to evaluate its impact on quality of care. Third, an appropriate incentive programme that is based on quality indicators is needed to introduce for improving quality of care in DRG system. Finally, it may be worthwhile to consider the introduction of new payment system as an alternative strategy to the DRG system, such as a bundled payment system that provides a fixed cost during a specific period and includes inpatient and outpatient health care services.

Our study has several limitations. First, we used claim data that did not measure certain characteristics of the patients, such as education level or income level, which could affect readmission. Second, our study included patients admitted for haemorrhoids; however, the results might vary for other DRG diseases. Third, we lacked an official definition of the hospital market in Korea; hence, our study relied on administrative districts as markets. Because our markets were defined as geographical areas, further studies will be required following the designation of official markets.

However, despite several limitations, our study has strengths. First, to the best of our knowledge, our study was the first to evaluate market competition and quality of care after the introduction of the DRG system in Korea. Second, we used NHI claim data and included a large sample of patients and hospitals regarding cases of haemorrhoids. Third, our study is helpful as a short-term evaluation of the introduction of the DRG system in Korea. Finally, our study examined changes in hospitals by market competition, which may provide insight to policymakers interested in the expansion of the DRG system in the future.

In conclusion, our study showed that the effects of the introduction of the DRG system differed by to degree of market competition. Generally, hospitals in high competition areas provided a high quality of care. However, the timing of introduction of DRG system affected quality of care, as we found different results following its implementation. Under the DRG system, a spillover effect was observed through the indirect indicator of quality of care irrespective of competitive status. Policymakers should consider two aspects for future payment systems—the inclusion of an alternative strategy as well as a new indicator for quality of care. In addition, a regular evaluation of the DRG system will be needed to improve quality of care and health efficiency.

Supplementary data

Supplementary data are available at *EURPUB* online.

Conflicts of interest: None declared.

Key points

- The introduction of new payment system may change hospital behaviour.
- Changes in hospital behaviour may vary by degree of competitiveness.
- Policymakers should consider the degree of market competitiveness when determining whether to maintain or expand the DRG system.
- We suggest that a quality measurement index should be developed to improve quality of care.

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